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(54) **SWITCH MATRIX**

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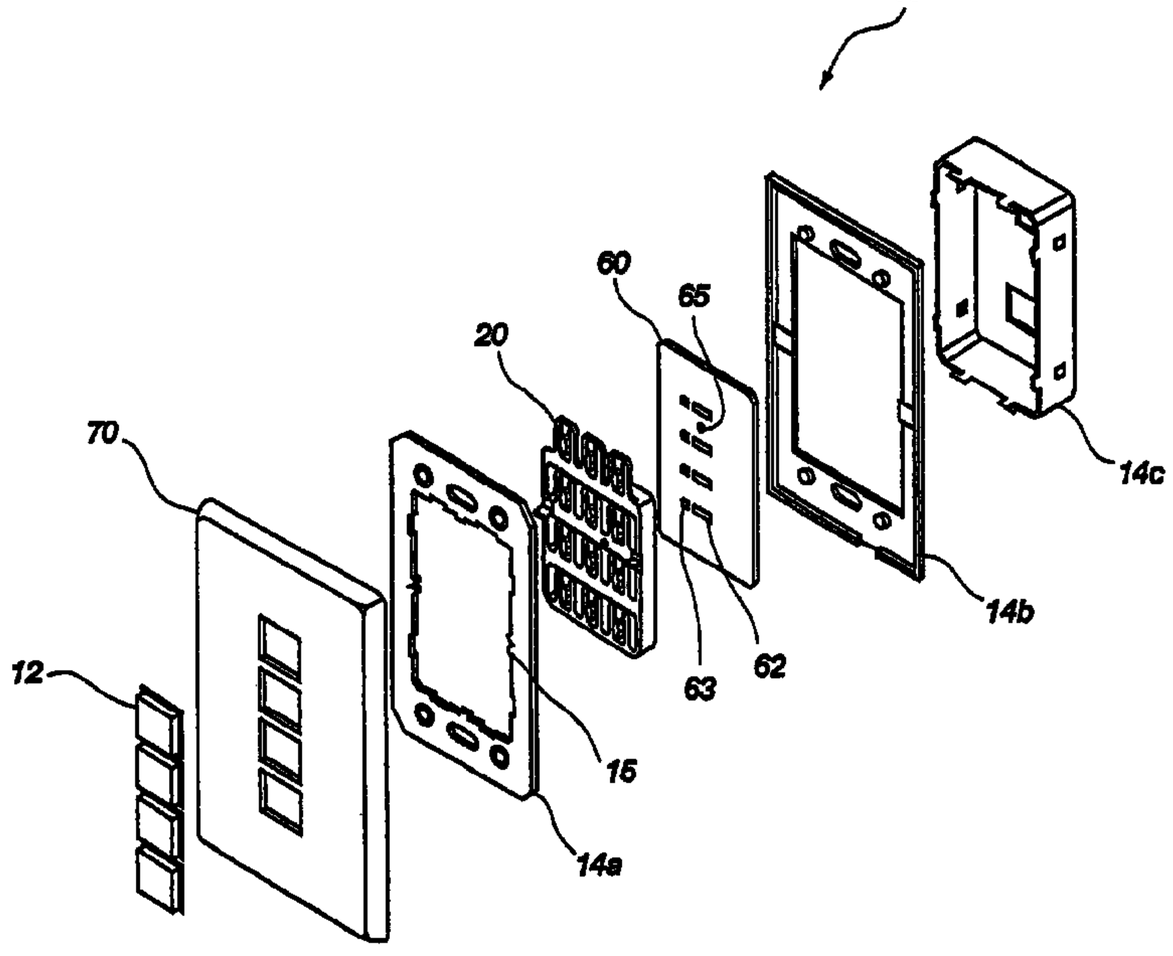
(57) **ABSTRACT**

A switch matrix is disclosed for keypads used in devices such as primary control points for automation systems in homes vehicles, or businesses. The switch matrix preferably includes a support frame for supporting a grid of key positioning members arranged in a series of rows and columns. The key positioning members each preferably include cantilevers which can be deflected by pressing the keys to activate switches associated with the keypad. The cantilevers preferably have knobs which are received in corresponding openings in the keys so that the keys can be removably attached to the cantilevers with a compression fit. This allows keys of different sizes and shapes to be easily attached to the keypad in various configurations without the need for different attaching devices for each situation.

53 Claims, 6 Drawing Sheets



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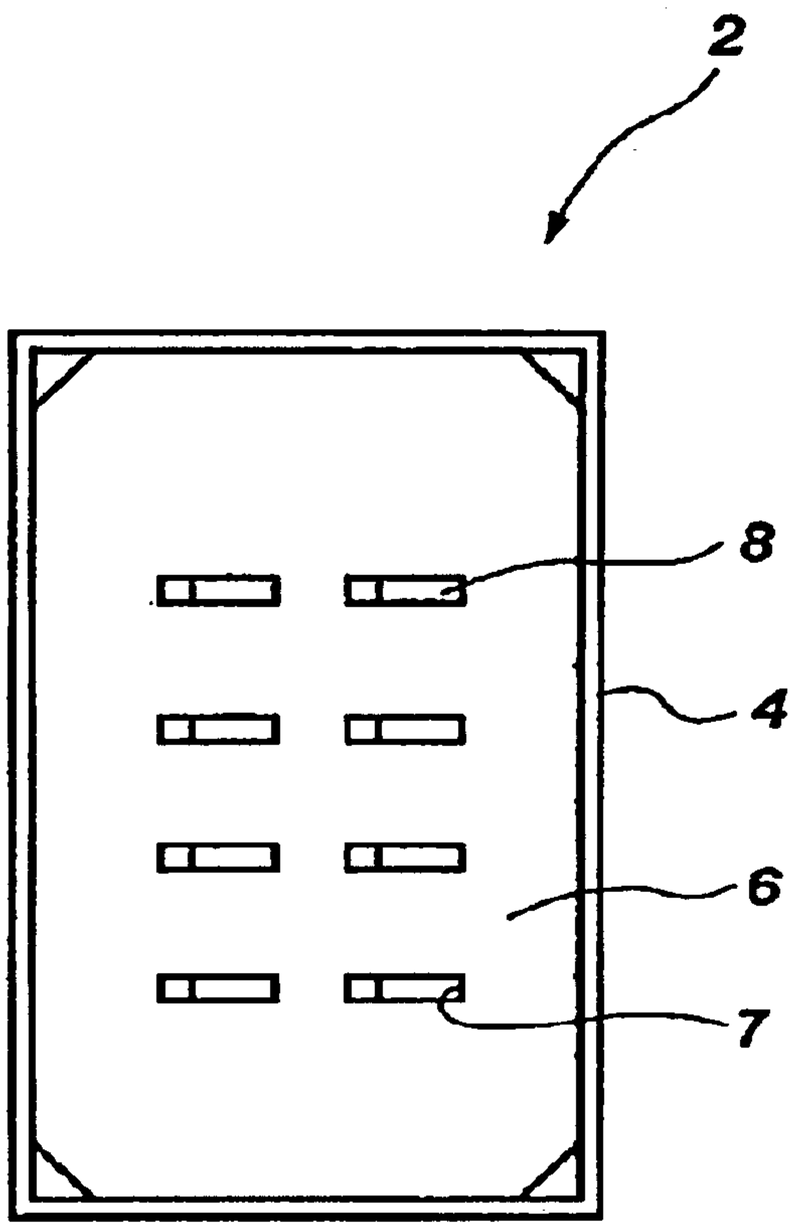

Fig. 1
(PRIOR ART)

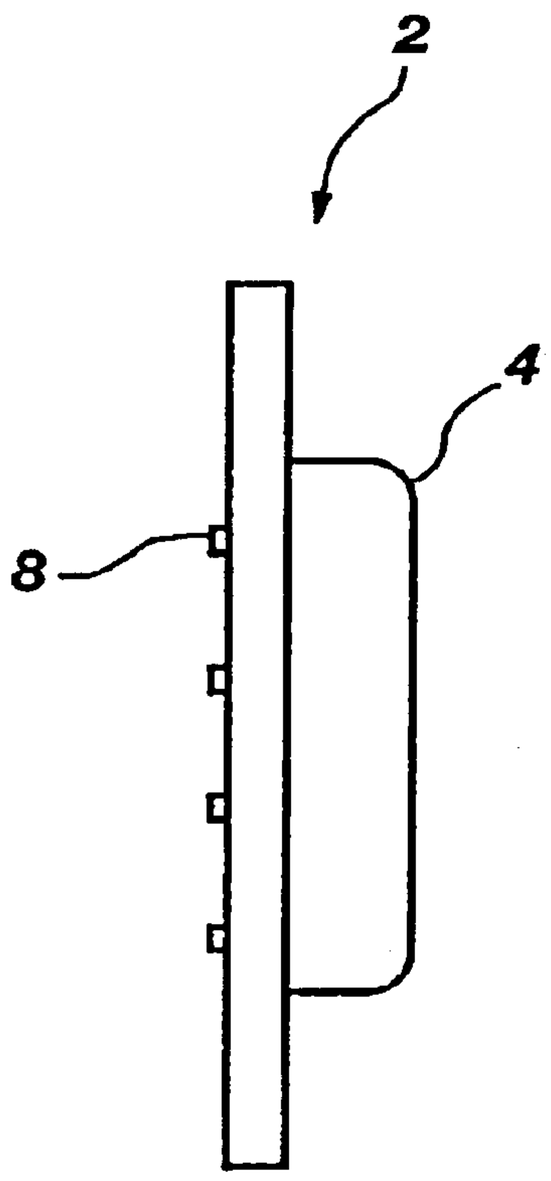

Fig. 2
(PRIOR ART)

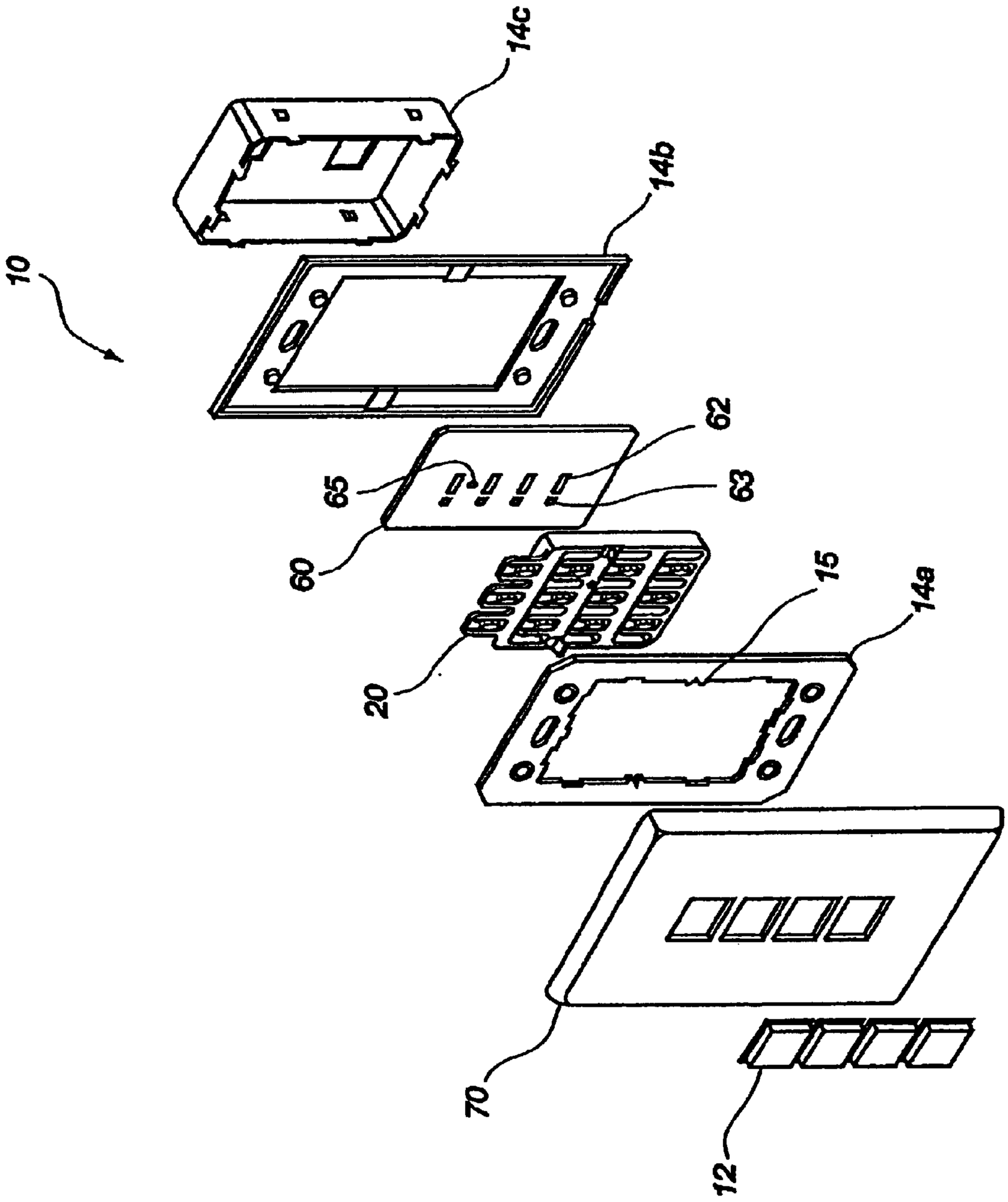

Fig. 3

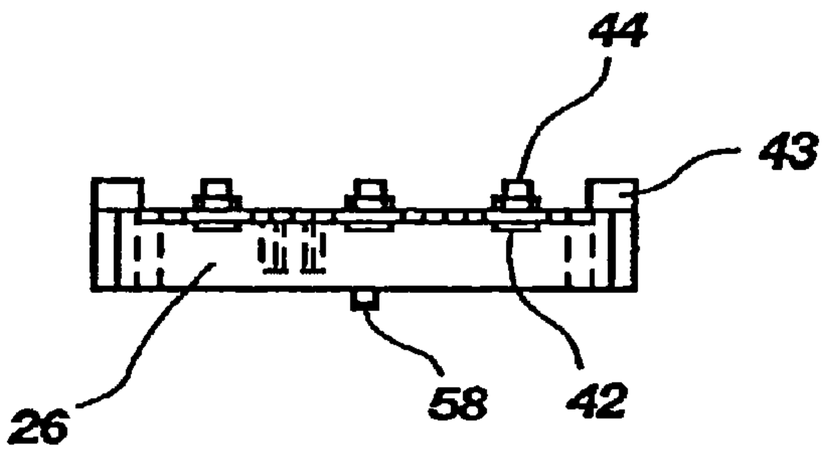

Fig. 6

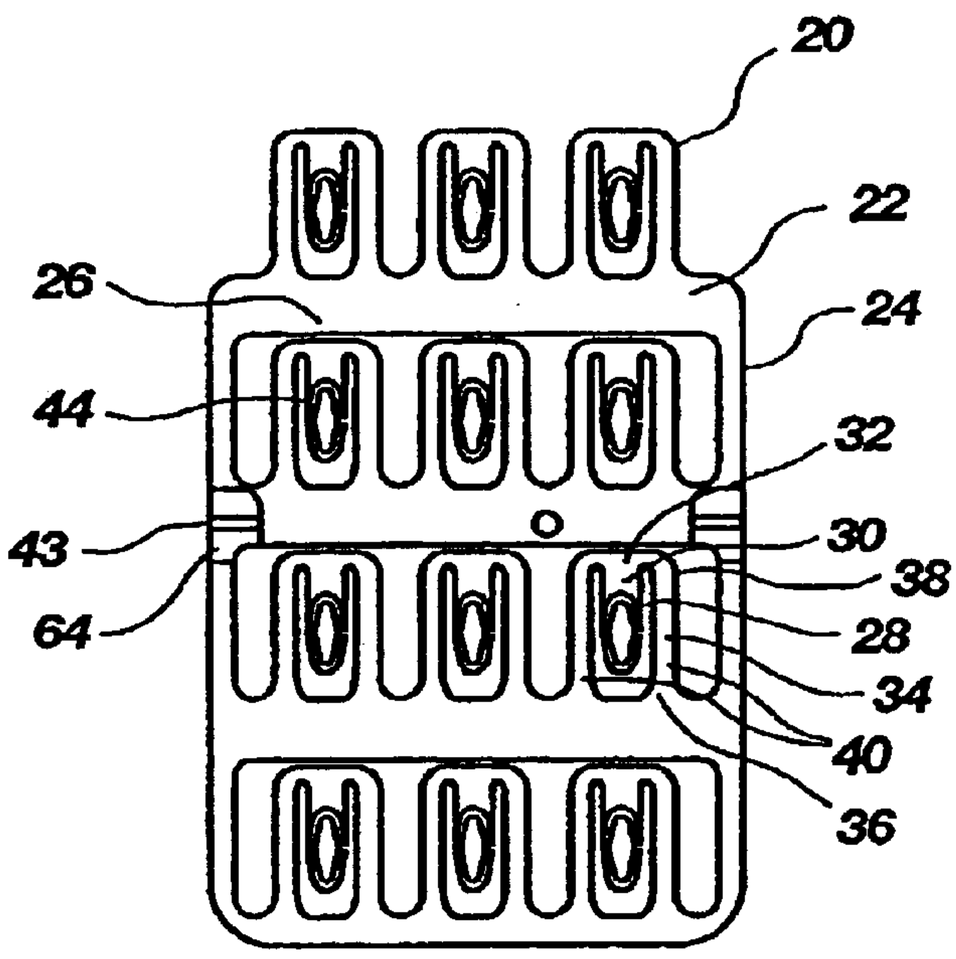

Fig. 4

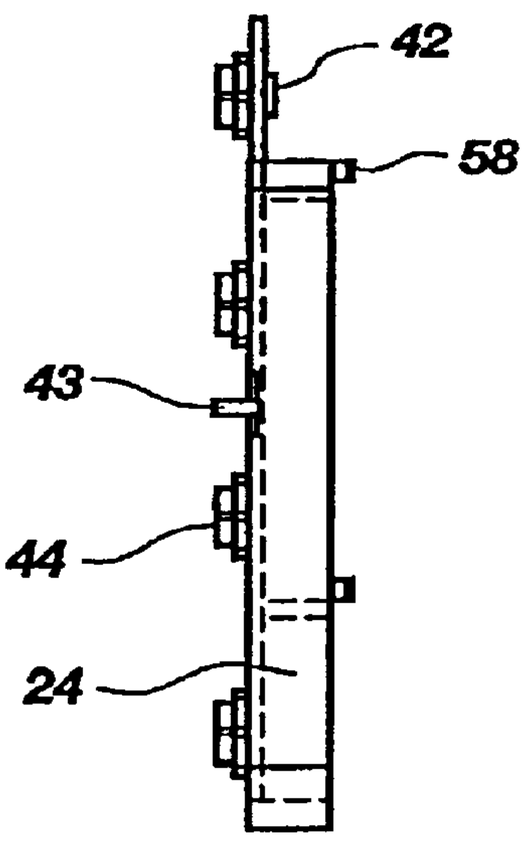

Fig. 5

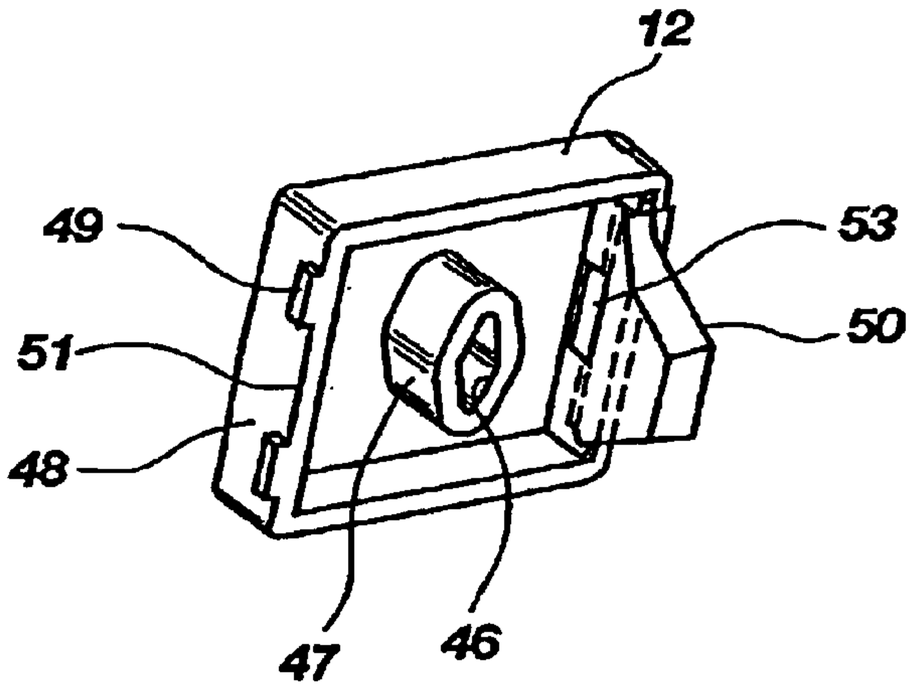

Fig. 7

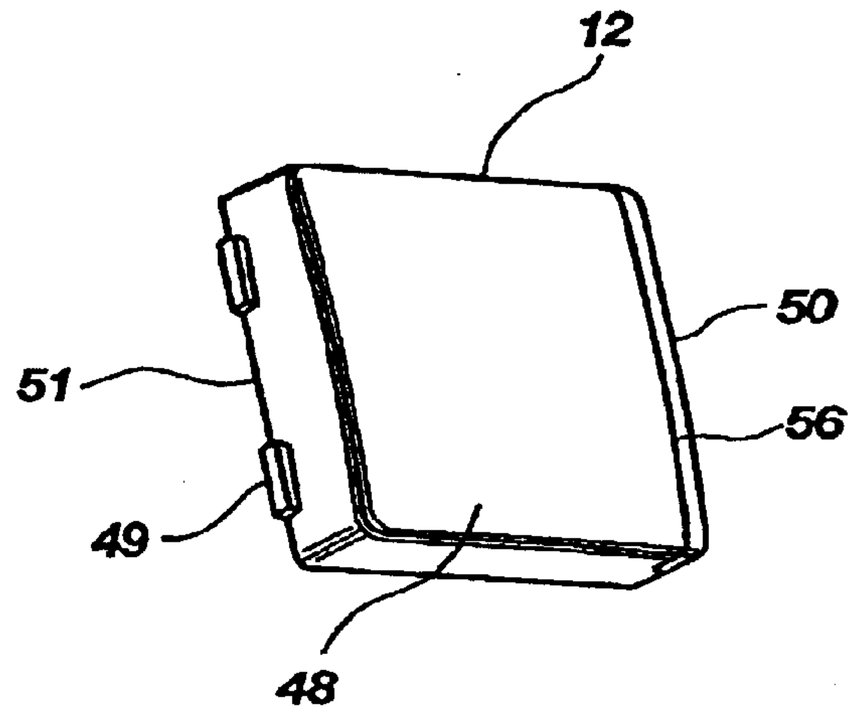

Fig. 8

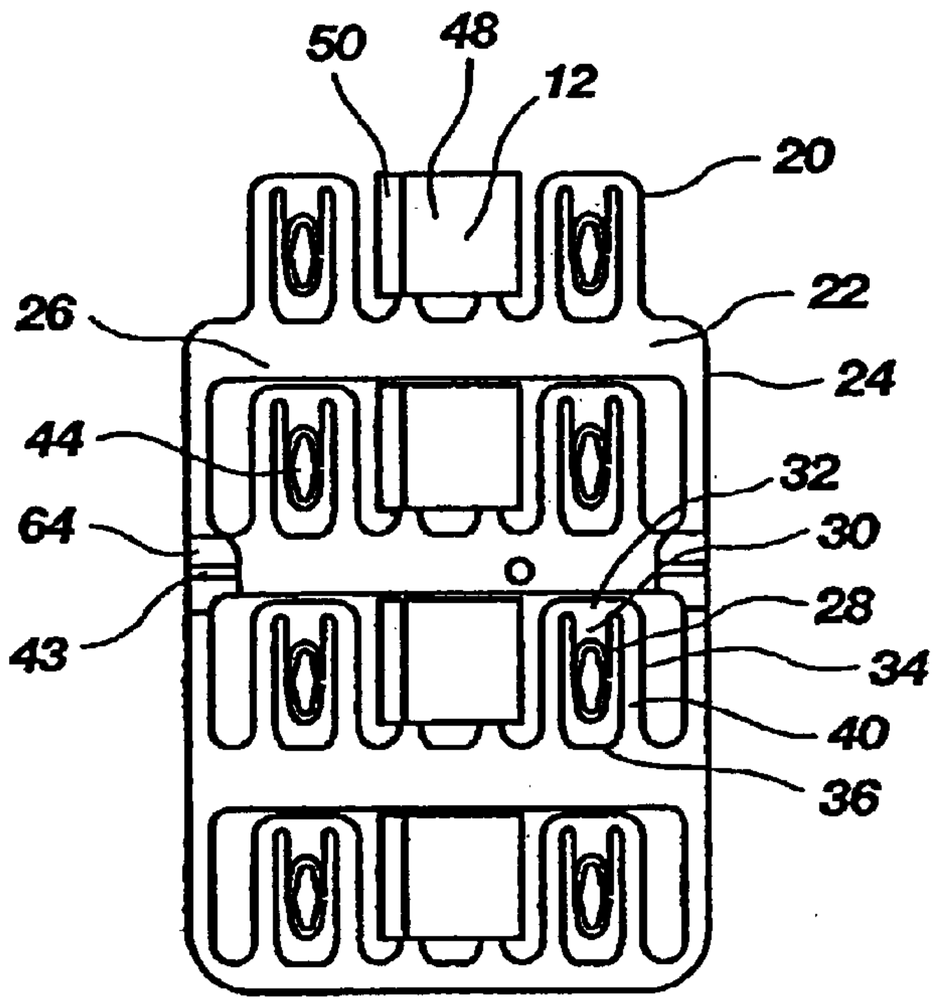

Fig. 9

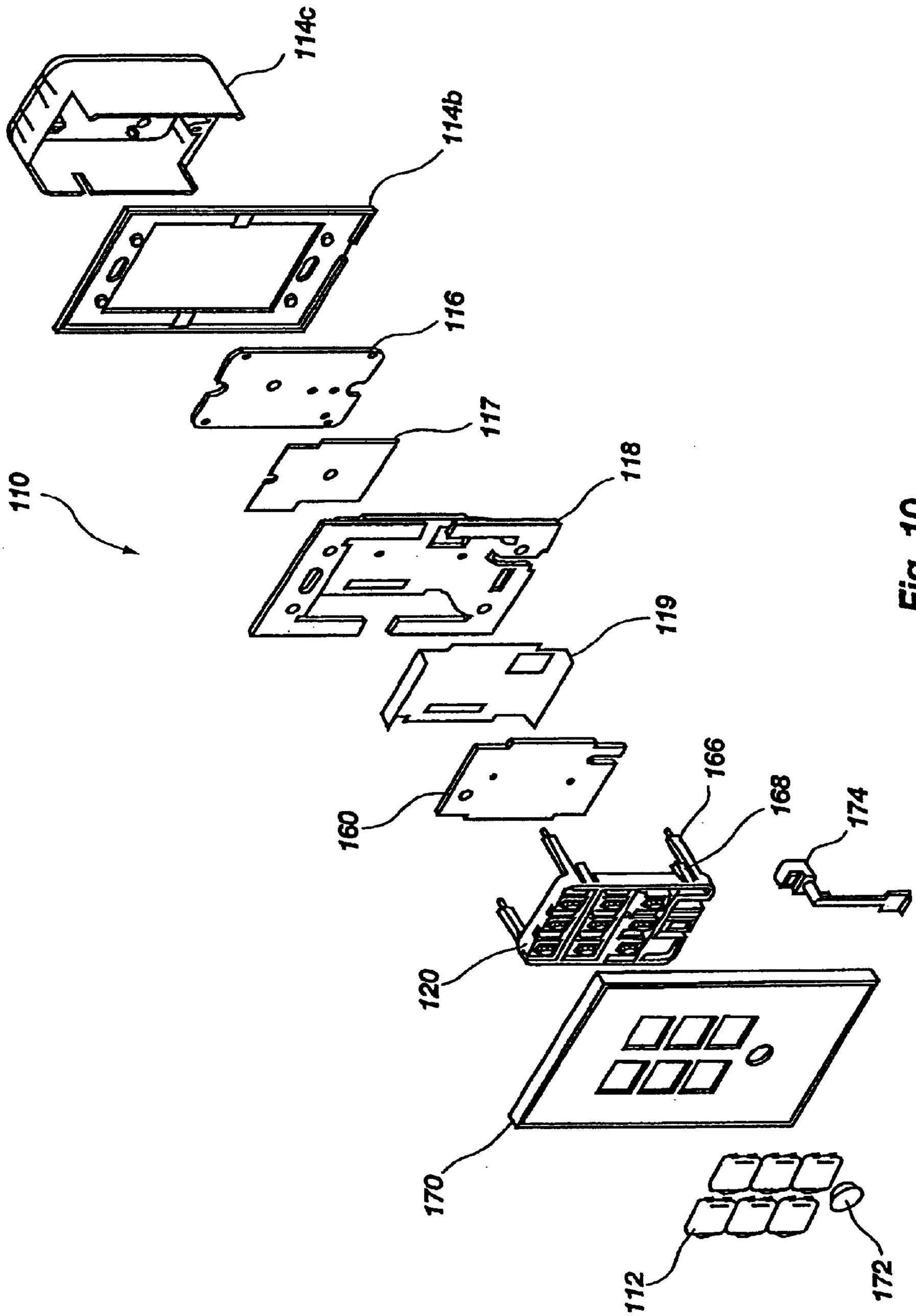

Fig. 10

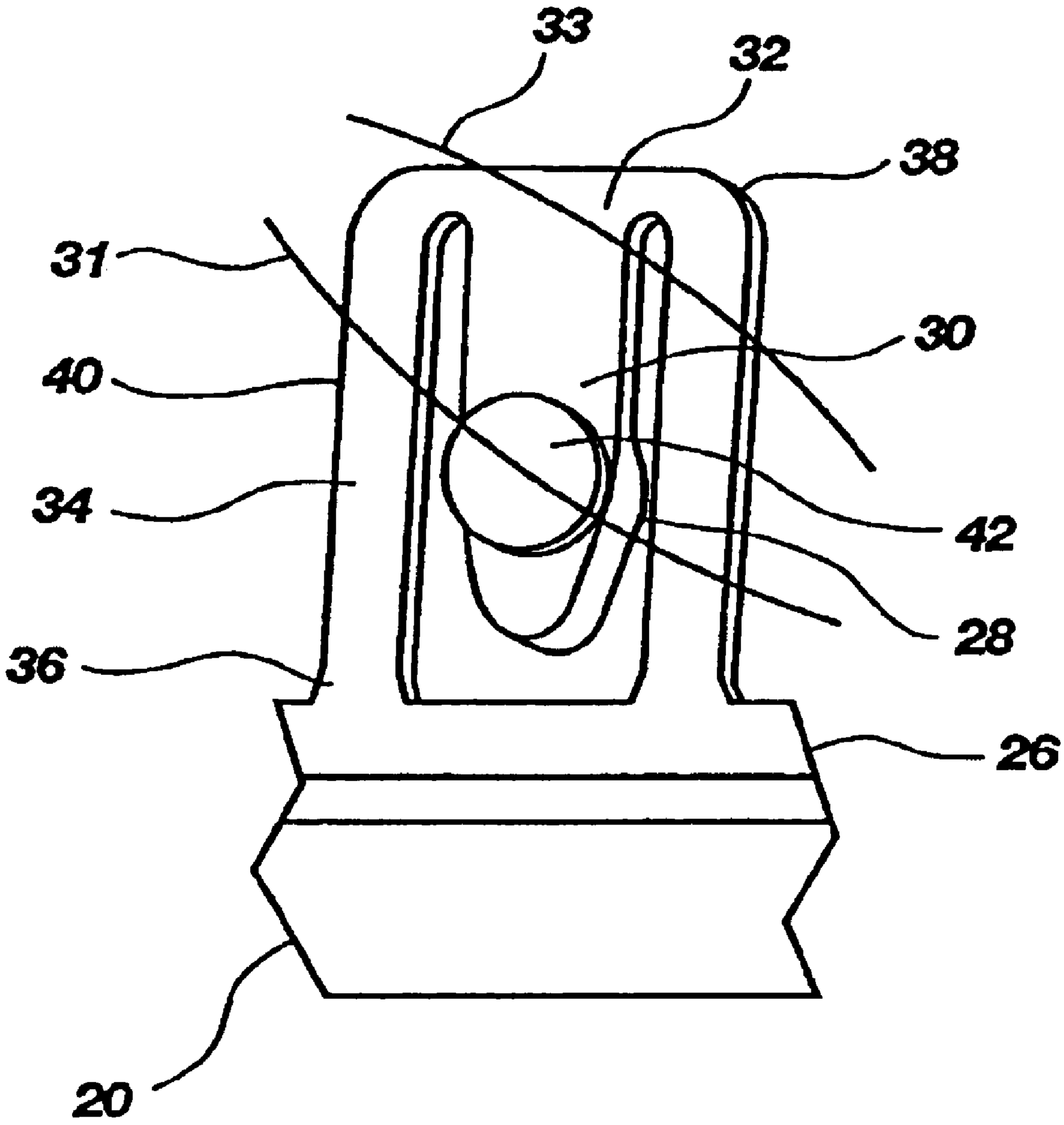

Fig. 11

SWITCH MATRIX

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of 10/024,129, filed Dec. 17, 2001, now U.S. Pat. No. 6,660,948 which claims the benefit of U.S. Provisional Application No. 60/272,020, filed Feb. 28, 2001, which is hereby incorporated by reference herein in its entirety, including but not limited to those portions that specifically appear hereinafter.

BACKGROUND OF THE INVENTION

1. The Field of the Invention

The present invention relates generally to keypad devices, and more particularly, but not necessarily entirely, to a switch matrix which allows the use of variable key positions and key sizes on the keypad.

2. Description of Related Art

It is common practice to provide keypads consisting of one or more keys arranged for entry of data or performing functions such as activating switches. Keypads are used for various types of electronic devices such as user interfaces for home automation and security systems, calculators, telephones, etc. Keypads commonly include an assembly of various parts maintained in a housing.

For example, FIG. **1** shows a keypad, generally indicated at **2**, known in the art for use as a primary control point for automation systems used in areas such as homes, businesses, boats, yachts, motor homes and busses. The keypad **2** includes a plurality of keys **8** which can be depressed to control systems such as lighting, security, audio visual and heating/cooling for example. The keys **8** are connected to electronic circuitry which is contained in a housing **4**. The keys **8** are fixed in place by an attaching plate **6** so as to be non-removable from the keypad **2**. The attaching plate **6** has apertures **7** through which the keys **8** protrude. The apertures **7** are sized and shaped to accommodate keys **8** of a particular size and shape. Therefore, a different attaching plate **6** is required for each size and shape of keys **8** used for the keypad **2**. Furthermore, the location of the keys **8** is confined to the locations of the apertures **7**. Therefore, a different attaching plate **6** must be used for different configurations of the keys **8**. Moreover, if any of the keys **8** become damaged or require replacement, the entire keypad **2** must be replaced or the attaching plate **6** must be removed. Removal of the attaching plate **6** is a difficult task which may require the services of a professional or use of specialized equipment since the attaching plate **6** is fixed to the housing **4** and is not designed to be easily removed without damaging the attaching plate **6** or the housing **4**.

The prior art is thus characterized by several disadvantages that are addressed by the present invention. The present invention minimizes, and in some aspects eliminates, the above-mentioned failures, and other problems, by utilizing the methods and structural features described herein.

In view of the foregoing state of the art, it would be an advancement in the art to provide a switch matrix which is capable of being used with keys of different sizes and shapes. It would be a further advancement in the art to provide a switch matrix which allows the keys to be arranged in different configurations using differing numbers of keys. It would also be an advancement in the art to provide a switch matrix which allows the keys to be easily installed and replaced without damaging the matrix.

BRIEF SUMMARY

In view of the above described state of the art, the present invention seeks to realize one or more of the following objects and advantages.

It is a primary object of the present invention to provide a switch matrix which is simple in design and manufacture.

It is another object of the present invention to provide such a switch matrix which is capable of being used with keys of different sizes and shapes.

It is a further object of the present invention, in accordance with one aspect thereof, to provide a switch matrix which allows the keys to be arranged in different configurations using differing numbers of keys.

It is an additional object of the invention, in accordance with one aspect thereof, to provide a switch matrix which allows the keys to be easily installed and replaced without damaging the matrix.

The above objects and others not specifically recited are realized in a specific illustrative embodiment of a switch matrix device. The device preferably includes a support frame including at least one longitudinal member and at least one lateral member substantially perpendicular to the longitudinal member. The switch matrix also preferably includes a grid of key positioning members disposed on the support frame in a series of rows and columns. The key positioning members each preferably include a first cantilever and a second cantilever. The second cantilever preferably includes a pair of arms. An attaching end of the first cantilever is preferably attached to a free end of the second cantilever such that the first cantilever extends parallel to the second cantilever between the pair of arms and towards the fixed end of the second cantilever. The first cantilever also preferably has a key attaching means for removably attaching a key to the key positioning member. The key attaching means preferably includes a knob which is adapted to be fitted into an opening in the keys with a corresponding shape to form a compression fit between the key and the attaching means. This allows the keys to be removably attached to the switch matrix so that keys of differing sizes and shapes may be utilized. The key positioning members are preferably configured to deflect when the key is depressed to activate a switch with a switch activating protrusion which is preferably disposed on the opposite side of the first cantilever from-the key attaching means. The keys can preferably be selectively attached to the key positioning members in various configurations suited for a particular application.

Additional objects and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by the practice of the invention without undue experimentation. The objects and advantages of the invention may be realized and obtained by means of the instruments and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the invention will become apparent from a consideration of the subsequent detailed description presented in connection with the accompanying drawings in which:

FIG. **1** is a front view of a prior art keypad for an automation system;

FIG. **2** is a side view of the prior art keypad of FIG. **1**;

FIG. **3** is an exploded perspective view of a keypad showing a preferred embodiment of the switch matrix of the present invention;

FIG. **4** is a plan view of a preferred embodiment of the switch matrix of the present invention;

FIG. **5** is a side view of the switch matrix of FIG. **4**;

FIG. **6** is an end view of the switch matrix of FIG. **4**;

FIG. **7** is a bottom perspective view of an exemplary embodiment of a key used in conjunction with the switch matrix of the present invention;

FIG. **8** is a top perspective view of the exemplary embodiment of the key of FIG. **7**;

FIG. **9** is a plan view of an exemplary embodiment of one of many key configurations made possible by the switch matrix of the present invention;

FIG. **10** is an exploded perspective view of an alternative embodiment of the switch matrix in a different keypad environment; and

FIG. **11** is a break-away perspective bottom view of a cantilever system of the switch matrix of FIGS. **3–6**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

For the purposes of promoting an understanding of the principles in accordance with the invention, reference will now be made to the preferred embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. Any alterations and further modifications of the inventive features illustrated herein, and any additional applications of the principles of the invention as illustrated herein, which would normally occur to one skilled in the relevant art and having possession of this disclosure, are to be considered within the scope of the invention claimed.

Referring now to FIG. **3**, an exploded perspective view of a keypad, generally indicated at **10**, is shown including a preferred embodiment of a switch matrix **20** of the present invention. The keypad **10** may be used as a user interface for home automation and security systems, for example. The keypad **10** preferably includes a plurality of keys **12** which can be depressed to control systems such as lighting, security, audio visual and heating/cooling for example. However, it will be appreciated by those skilled in the art that the keypad **10** may be used in other environments within the scope of the present invention. Other such environments include calculators, telephones, and office equipment, for example.

A housing assembly **14** for the keypad **10** may be configured in various forms. The housing assembly **14** is shown in FIG. **3**, as a combination of a front plate **14***a*, a back plate **14***b* and a back box **14***c*, which can be joined together in any suitable manner well known to those skilled in the art. The housing assembly **14** preferably receives electronic control devices such as electronic circuitry board **60** containing switches **62** which can be activated to perform a particular function. Any number of different types of electronic circuitry boards **60** can be utilized within the scope of the present invention and such electronic circuitry boards **60** can readily be arrived at by those skilled in the pertinent art. Switches **62** may be of any variety known in the art which are activated by a mechanical action such as a pressing force. For example, switches **62** may include resilient members which are deflected by a force to close a circuit, and upon release of the force, the resilient members rebound to open the circuit. The electronic circuitry board **60** may be attached to the housing assembly **14** in any suitable manner known in the art such as soldering, adhesives or fasteners, for example. The switch matrix **20** is preferably attached to the housing assembly **14**, as described more fully below, such that keys **12** may be attached to the switch matrix **20** to correspond to the location of the switches **62**. A face plate **70** preferably covers the switch matrix **20** to improve the appearance of the keypad **10** and to provide further protection of the contents of the housing assembly **14**. The face plate **70** may be attached to the housing assembly **14** in any manner known in the art such as magnets or fasteners, for example.

Referring now to FIG. **4**, a plan view of a preferred embodiment of the switch matrix **20** is shown. The switch matrix **20** preferably includes a support frame **22**. The support frame **22** preferably includes at least one longitudinal member **24** and at least one lateral member **26** which, in the illustrated embodiment, are substantially perpendicular to each other. More preferably, the support frame **22** includes two longitudinal members **24** and a plurality of lateral members **26** arranged to support a grid of key positioning members **28**.

The key positioning members **28** preferably include a first cantilever **30** having an attached end **32**, shown most clearly in FIG. **11**. The attached end **32** of the first cantilever **30** is preferably attached to a free end **38** of a second cantilever **34**. The second cantilever **34** is preferably disposed on the support frame **22** at a fixed end **36** and includes a pair of spaced apart arms **40** such that the first cantilever **30** may reside between the arms **40** and parallel to the arms **40**. The configuration of the first cantilever **30** and the second cantilever **34** allows for improved deflection and force transfer capabilities in that the key positioning member **28** allows for deflection in a substantially linear direction. For example, the first cantilever **30** preferably deflects in a curved path **31** with respect to the attached end **32**. Whereas the second cantilever **34** deflects in a oppositely curved path **33** with respect to the fixed end **36** of the second cantilever **34**. The opposite curvature of curved path **31** of the first cantilever **30** and the curved path **33** of the second cantilever **34**, tend to reduce the amount of curvature in travel path of the key positioning member **28** such that deflection of the key positioning member **28** takes place in a substantially linear direction.

A switch activating protrusion **42**, shown in FIGS. **6** and **11**, is preferably disposed on a bottom side of the first cantilever **30**. The switch activating protrusion **42** is configured to contact the switch **62** (see FIG. **3**) as the first cantilever **30** is depressed. The upper side of the first cantilever **30** preferably includes a knob **44** which may be inserted into an opening **46** defined by a sidewall **47** of the key **12**, as shown in FIG. **7**. The knob **44** and opening **46** are preferably sized to create a compression or friction fit between the key **12** and the knob **44** such that the key **12** is held tightly in place. However, the key **12** is not permanently fixed to the knob **44** such that the key **12** may be removed from the knob **44** if desired. The knob **44** is one preferred example of a key attaching means. Other means for removably attaching a key **12** to the switch matrix **20** may be used within the scope of the present invention. For example, the knob **44** may be located on the key **12** and the opening **46** may be located on the switch matrix **20**.

It will be appreciated that the structure and apparatus disclosed herein is merely one example of a key attaching means for removably attaching a key to the switch matrix, and it should be appreciated that any structure, apparatus or system for removably attaching a key to the switch matrix which performs functions the same as, or equivalent to, those disclosed herein are intended to fall within the scope

of a means for removably attaching a key to the switch matrix, including those structures, apparatus or systems for removably attaching a key to the switch matrix which are presently known, or which may become available in the future. Any structure which functions the same as, or equivalently to, the herein described means for removably attaching a key to the switch matrix falls within the scope of this element as set forth in the claims.

The knob **44** (FIG. **6**) may have a diamond shape, for example, which corresponds to the opening **46** also having a diamond shaped and provided in the key **12**. As those skilled in the art will appreciate, knobs **44** and openings **46** of other shapes, and other structures to removably attach the key **12** to the switch matrix **20**, may be used within the scope of the present invention. Furthermore, the size and shape of the key **12** is not dependant upon the means for removably attaching the key **12** to the switch matrix **20**. In the prior art system shown in FIG. **1**, the apertures **7** of the attaching plate have a size and shape configured for specific keys, whereas the switch matrix **20** of the present invention advantageously allows keys **12** of various sizes and shapes to be attached. Those skilled in the art will appreciate that advantages which the present invention provides by allowing different number of keys and different sizes and shapes of keys to be utilized.

The switch matrix **20** may also include abutments **43** on opposing sides of the support frame **22**, as shown most clearly in FIGS. **4–6**. The abutments **43** may project from the switch matrix **20** to contact the face plate **70** to prevent the face plate **70** from flexing into the knobs **44**. The abutments **43** may therefore prevent activation of the switches **62** due to forces applied to the face plate **70**.

FIGS. **7** and **8** show an exemplary embodiment of the key **12**. Many different variations of key **12** may be formed utilizing various sizes and shapes in addition to those shown in the figures. For example, the keys **12** may be round, triangular, oval, polygonal, or in the shape of objects such as arrows, waves or light bulbs or any other shape. Preferably, keys **12** include a key body **48** and a light pipe **50**. The key body **48** provides a surface area which can be depressed by a human user to activate the switch **62** (see FIG. **3**). The key body **48** may also be engraved or labeled to provide an indication of the function of the key **12**. The key **12** may further include one or more stops **49** to prevent the key **12** from passing through the face plate **70**. The stops **49** may be segmented or continuous around a bottom edge **51** of the key **12**.

The light pipe **50** is preferably made of a translucent material which directs light from a light source **63** (see FIG. **3**) located below the key **12** to the upper surface **56** of the key **12**. Thus the light pipe **50** allows the transmission of light from the electronic circuitry board **60** to the upper surface **56** of the key **12** to provide visual signals to the user. The light pipe **50** is preferably attached to the key body **48** without the use of adhesive or tools. For example, the light pipe **50** may have a projection (not shown) which may be inserted into a cavity (not shown) in the key body **48** such that the light pipe **50** is held to the key body **48** through friction. The key body **48** may be configured with cut-out portions, such as depicted at **53** in FIG. **7**, to reduce the amount of material required to manufacture the key body **48** where possible.

The light source **63** is preferably located on the electronic circuitry board **60** in close proximity to the switches **62** as shown in FIG. **3**. The light source **63** may include one or more light emitting diodes, for example. The light source **63** may utilize a single or multiple colors, and may be programmed to blink, change colors, or vary in illumination intensity to indicate the status of the keypad **10**. It will be appreciated that other devices for generating light may be used within the scope of the present invention.

The switch matrix **20** also preferably includes aligning posts **58**, as shown in FIGS. **5** and **6**, which extend from an undersurface of the switch matrix **20** to register with recesses **65** on the electronic circuitry board **60** (FIG. **3**). The aligning posts **58** align the switch matrix **20** so that the switch activating protrusions **42** register properly with the switches **62**. It will be appreciated that other structures may be used within the scope of the present invention to align the switch matrix **20** with the electronic circuitry board **60**.

The switch matrix **20** also preferably includes grooves **64** disposed in the support frame **22**. The grooves **64** are preferably configured to receive tabs **15** (see FIG. **3**) located on the housing assembly **14** to hold the switch matrix **20** in place with respect to the housing assembly **14**. It will be appreciated by those skilled in the art that other structures besides the grooves **64** and the tabs **15** may be used within the scope of the present invention to hold the switch matrix **20** in place with respect to the housing assembly **14**.

The switch matrix **20** is preferably formed as a single piece from molded plastic. However, as those skilled in the art will appreciate, other materials may be used to form the switch matrix **20** within the scope of the present invention.

In use, keys **12** are attached to any or all of the key positioning members **28** to correspond with the position of the switches **62** on the electronic circuitry board **60**. An exemplary configuration of the keys **12** on the switch matrix **20** is shown in FIG. **9**. It will be appreciated that numerous different configurations of keys **12** are possible in addition to that shown in FIG. **9**. A key **12** may be so large as to cover multiple key positioning members **28**, or small enough such that a key **12** may be attached to all key positioning members **28**. Furthermore, the switch matrix **20** may be constructed to contain any different number of key positioning members **28** such that the number of possible key configurations is very large. The keys **12** may be attached to the switch matrix **20** in a desired configuration without the need for making modifications to the switch matrix **20**. Therefore, the switch matrix **20** can be more easily installed at a location in the field where the switch matrix **20** is being installed since the need for specialized tools or equipment, as required by the prior art, is eliminated. Furthermore, the switch matrix **20** is adapted for numerous different key configurations so a single switch matrix **20** can be used in the place of multiple attaching plates **6** as required by the prior art for different key configurations.

If the need arises to repair or replace a key **12**, the key **12** may simply be detached from the switch matrix **20** by pulling on the key **12** with sufficient force to overcome the compression fit between the knob **44** and the opening **46**. This can be done without removing the switch matrix **20** from the housing assembly **14**, and without damaging the switch matrix **20**. The ease with which the keys **12** may be replaced allows users to maintain and repair the keys **12** without the need for purchasing a new keypad **10**, obtaining specialized tools or hiring a technician to perform the work.

Reference will now to made to FIG. **10** to describe a second presently preferred embodiment of the present invention. As previously discussed, the presently preferred embodiments of the invention illustrated herein are merely exemplary of the possible embodiments of the invention, including that illustrated in FIG. **10**.

It will be appreciated that the second embodiment of the invention illustrated in FIG. **10** contains many of the same structures represented in FIGS. **1–9** and only the new or different structures will be explained to most succinctly explain the additional advantages which come with the embodiment of the invention illustrated in FIG. **10**. The second embodiment of the inventive switch matrix **120** is shown in a different keypad environment **110**. The second embodiment of the switch matrix **120** preferably includes legs **166** to support and align the switch matrix **120** within the keypad **110**. The switch matrix **120** also preferably includes clips **168** to attach the switch matrix **120** to other components of the keypad **110**. Other components of the keypad **110** may include a back box **114***c*, a back plate **114***b*, an additional printed circuit board **116**, a first insulator **117**, a bracket **118** and a second insulator **119**. The keypad **110** may also include an optional input unit **172**. The optional input unit **172** may include a built in infrared receiver which may allow a user to transmit commands to the keypad **110** from a remote location. The keypad **110** may also have a service switch lever **174** for performing functions such as cutting the flow of electricity in the keypad **110**. It will be appreciated that numerous other configurations of components of the keypad **110** may be used within the scope of the present invention. The components of the keypad **110** illustrated in FIG. **10** are merely exemplary of the numerous environments in which the switch matrix **120** may be utilized.

In view of the foregoing, it will be appreciated that the present invention provides a switch matrix which is capable of being used with keys of different sizes and shapes. The present invention also provides a switch matrix which allows the keys to be arranged in different configurations using differing numbers of keys. The present invention further provides a switch matrix which allows the keys to be easily installed and replaced without damaging the matrix.

It is to be understood that the above-described arrangements are only illustrative of the application of the principles of the present invention. Numerous modifications and alternative arrangements may be devised by those skilled in the art without departing from the spirit and scope of the present invention and the appended claims are intended to cover such modifications and arrangements. Thus, while the present invention have been shown in the drawings and fully described above with particularity and detail in connection with what is presently deemed to be the most practical and preferred embodiments of the invention, it will be apparent to those of ordinary skill in the art that numerous modifications, including, but not limited to, variations in size, materials, shape, form, function and manner of operation, assembly and use may be made without departing from the principles and concepts set forth herein.

What is claimed is:

1. A switch matrix for use in a keypad, said switch matrix comprising:

a support frame; and

at least one key positioning member disposed on said support frame, said at least one key positioning member comprising a first cantilever and key attaching means for removably attaching a key to said key positioning member;

wherein keys of different sizes and shapes may be attached to said switch matrix.

2. The switch matrix of claim **1** further comprising a switch activating protrusion disposed on said first cantilever.

3. The switch matrix of claim **2** wherein said switch activating protrusion is disposed on an opposite side of said first cantilever from said key attaching means.

4. The switch matrix of claim **1** further comprising a second cantilever having a fixed end and a free end, said second cantilever being connected to the support frame.

5. The switch matrix of claim **4** wherein said first cantilever is disposed on said free end of said second cantilever.

6. The switch matrix of claim **5** wherein a free end of said first cantilever extends in a direction toward said fixed end of said second cantilever.

7. The switch matrix of claim **4** wherein said first cantilever extends parallel to said second cantilever.

8. The switch matrix of claim **4** wherein said second cantilever comprises a pair of arms, and wherein said first cantilever resides between the pair of arms of the second cantilever.

9. The switch matrix of claim **1** wherein said support frame comprises at least one longitudinal member and at least one lateral member substantially perpendicular to said longitudinal member.

10. The switch matrix of claim **9** wherein said support frame comprises two longitudinal members and four lateral members.

11. The switch matrix of claim **1** wherein said support frame comprises at least one groove for attaching said switch matrix to said keypad.

12. The switch matrix of claim **1** wherein said at least one key positioning member comprises a plurality of key positioning members disposed in a series of rows and columns.

13. The switch matrix of claim **12** wherein said series of rows and columns comprises four rows and three columns to include twelve key positioning members.

14. The switch matrix of claim **1** wherein said key attaching member comprises a knob.

15. The switch matrix of claim **14** wherein said knob is substantially diamond shaped.

16. The switch matrix of claim **1** further comprising at least one stud disposed thereon for aligning the switch matrix so that the keys register with switches.

17. The switch matrix of claim **1** further comprising at least one leg for supporting said switch matrix in said keypad.

18. The switch matrix of claim **1** further comprising at least one resilient clip for attaching said switch matrix to other components within said keypad.

19. A switch matrix for use in a keypad, said switch matrix comprising:

a plurality of key positioning members, each of the key positioning members comprising a first cantilever having an attached end, and a second cantilever having a fixed end and a free end, said attached end of said first cantilever disposed on said free end of said second cantilever;

wherein said each of said key positioning members are configured to receive a key.

20. The switch matrix of claim **19** further comprising a switch activating protrusion disposed on said first cantilever.

21. The switch matrix of claim **19** further comprising key attaching means for removably attaching said key to said plurality of key positioning members.

22. The switch matrix of claim **21** wherein said key attaching means comprises a knob.

23. The switch matrix of claim **22** wherein said knob is substantially diamond shaped.

24. The switch matrix of claim **19** wherein a free end of said first cantilever extends in a direction toward said fixed end of said second cantilever.

25. The switch matrix of claim **19** wherein said first cantilever extends parallel to said second cantilever.

26. The switch matrix of claim **19** wherein said second cantilever comprises a pair of arms, and said first cantilever resides between said pair of arms of said second cantilever.

27. The switch matrix of claim **19** further comprising a support frame for supporting said plurality of key positioning members.

28. The switch matrix of claim **27** wherein said support frame comprises at least one groove for attaching said switch matrix to said keypad.

29. The switch matrix of claim **27** wherein said support frame comprises at least one longitudinal member and at least one lateral member substantially perpendicular to said longitudinal member.

30. The switch matrix of claim **29** wherein said support frame comprises two longitudinal members and four lateral members.

31. The switch matrix of claim **19** wherein said plurality of key positioning members are disposed in a series of rows and columns.

32. The switch matrix of claim **19** further comprising at least one stud disposed thereon for aligning the switch matrix so that the keys register with switches.

33. The switch matrix of claim **19** further comprising at least one leg for supporting said switch matrix in said keypad.

34. The switch matrix of claim **19** further comprising at least one resilient clip for attaching said switch matrix to other components within said keypad.

35. A switch matrix for use in a keypad, said switch matrix comprising:

a plurality of key positioning members, each of said plurality of key positioning members comprising a knob; and

at least one key having an opening defined by a sidewall, said opening configured to receive said knob to removably attach said at least one key to said knob with a friction fit;

wherein said at least one key may be attached to any of said plurality of key positioning members such that a configuration of said at least one key on said keypad may be varied.

36. The switch matrix of claim **35** wherein said at least one key further comprises a light pipe to direct light from a lower surface of said at least one key to an upper surface of said at least one key.

37. The switch matrix of claim **36** wherein said light pipe is attached to said key by interfitting parts such that no adhesive or fasteners are required.

38. The switch matrix of claim **35** wherein said plurality of key positioning members each comprise a first cantilever deflectable to contact a switch.

39. The switch matrix of claim **38** wherein said first cantilever comprises an attached end, said attached end of said first cantilever being attached to a second cantilever.

40. The switch matrix of claim **39** wherein said second cantilever comprises a pair of arms, and said first cantilever resides between said pair of arms of said second cantilever.

41. The switch matrix of claim **35** further comprising a support frame for supporting said plurality of key positioning members.

42. The switch matrix of claim **41** wherein said support frame comprises at least one longitudinal member and at least one lateral member substantially perpendicular to said longitudinal member.

43. The switch matrix of claim **41** wherein said support frame comprises at least one groove for receiving a tab to attach said switch matrix to said keypad.

44. The switch matrix of claim **35** wherein said plurality of key positioning members are disposed in a series of rows and columns.

45. The switch matrix of claim **35** wherein said knob is substantially diamond shaped.

46. A method of attaching one or more keys to a keypad comprising the steps of:

(a) providing a switch matrix having a plurality locations where said one or more keys may be attached;

(b) attaching said switch matrix to said keypad;

(c) providing said one or more keys of a first size and shape;

(d) selecting one or more of said plurality of locations on said switch matrix to attach said one or more keys; and

(e) pressing said one or more keys on said one or more of said selected plurality of locations to attach said one or more keys to said keypad.

47. The method of claim **46** further comprising covering said switch matrix with a face plate.

48. The method of claim **46** wherein step (e) further comprises joining a knob on said one or more of said selected plurality of locations with an opening on said one or more keys to fasten said one or more keys to said keypad with a friction fit.

49. The method of claim **46** further comprising removing said one or more keys from said keypad by pulling on said one or more keys.

50. The method of claim **49** further comprising providing one or more keys of a second size and shape different from said first size and shape, and pressing said one or more keys of said second size and shape on said one or more of said selected plurality of locations to attach said one or more keys of said second size and shape to said keypad.

51. The method of claim **49** further comprising selecting another one or more of said plurality of locations and pressing said one or more keys on said another one or more of said plurality of locations to attach said one or more keys to said keypad.

52. A method for attaching keys of different sizes and shapes to a keypad, said method comprising:

(a) providing a plurality of attaching means for removably attaching said keys;

(b) providing said keys having corresponding attaching means independent of the size and shape of said keys;

(c) selecting a configuration of said keys to be attached on said keypad;

(d) selecting said attaching means corresponding to the configuration of said keys to be attached on said keypad; and

(e) joining said corresponding attaching means to said selected attaching means to thereby attach said keys to said keypad.

53. A switch matrix for use in a keypad, said switch matrix comprising:

a grid of key attaching means for removably attaching keys to said switch matrix;

wherein said keys may be selectively attached to said key attaching means to form different key configurations.

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